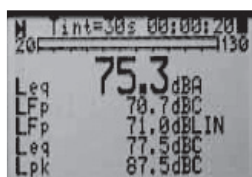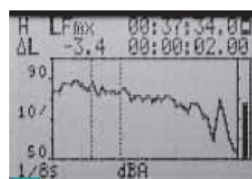## HD2110L

Integrating Sound Level Meter
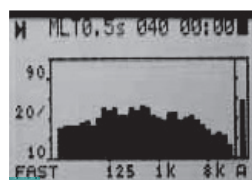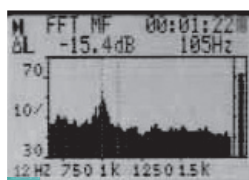

Basic screen
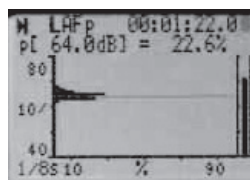

Time profile
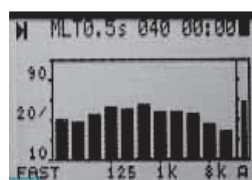
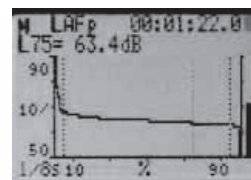**Octave band spectrum**

Third octave band spectrum, optional

Narrow band spectrum analysis (FFT option)

Statistical analysis: probability distribution of sound levels

Statistical analysis: percentile levels

◑ HD 2110L

Integrating Sound Level Meter - Portable Analyzer

the HD2110L is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed in order to offer high-performance analysis of acoustic phenomena. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2110L can be integrated with other options to extend its application scope at any time; the firmware can be updated directly by the user by means of the Noise Studio program supplied with the instrument.

Technical regulations:

✓ **Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C),** IEC 60651 and IEC 60804
✓ Class 1 octave and third octave filters according to IEC 61260
✓ Microphone in compliance with IEC 61094-4

Specifications:

✓ Real-time octave and third octave band spectrum analysis from 16 Hz to 20 kHz,
✓ Real-time third octave band with two filters bank: from 16 Hz to 20 kHz and from 14Hz to 18kHz (**opt. HD2110.O1**)
✓ Narrow-band spectral analysis (FFT) with variable resolution from 1.5Hz to 100Hz and capture of the Leq profile at intervals of 1/32s (**opt. HD2110.O6**).
✓ Statistical analysis with calculation of the probability distribution in classes from 1.5dB and of all the percentiles from L_1 to L_{99},
✓ Estimate of the audibility of spectral components through comparison with equal loudness curves in real time
✓ Simultaneous storage of multi-parameter profiles, reports and records at programmable intervals associated with sound events identified Automatically or manually,
✓ Measure of the reverberation time by using the method of the interrupted source and with the method of the integration of the response to impulse (**opt. HD2110.O4**)

Applications:

✓ Noise monitoring with sound event capture and analysis function,
✓ <u>Identification of tonal components even at the standard third octave band,</u>
✓ <u>Estimate of the audibility of spectral components through comparison with equal loudness curves in real time,</u>
✓ Measurement in workplaces and selection of the individual protection devices (methods SNR, HML and OBM),
✓ Sound insulation and reclamation,
✓ Production quality control and measurement of machine noise,
✓ Architectural acoustic and building measures.

Inputs and outputs

✓ Unweighted LINE Input/Output (jack Ø 3.5mm).
✓ Output DC LAFp 1/8s
✓ TRIGGER Input/Output (jack Ø 3.5mm).
✓ RS232C standard serial port in compliance with EIA/TIA574. Baud Rate from 300 to 115200 bauds.
✓ USB 1.1 serial port.
✓ 9...12Vdc external power supply unit (jack Ø 5.5mm).

Software for /98/XP/Vista/7 Windows® operating systems

CH20 : Hardware key for PC working with Windows® operating systems.
When inserted into a USB port, it enables the PC to use software modules of the Noise Studio programme.

Noise Studio: Software for Windows® 98, XP, Vista, 7 versions supplied with

graphical display of stored data are available. This programme supports some sound analysis application forms which can be enabled by licence with the hardware key. The programme contains demo versions of the modules.
▪ This Noise Studio programme allows connecting the HD2110L to a PC in a very easy and intuitive way. Its main functions are:
▪ Transfer of data from the sound level meter to PC memory.
▪ Display in a graphical or tabular form of the data acquired.
▪ Export to Excel and PDF formats.
▪ Printing of charts and data tables.
▪ Comparison of spectra for third octave bands with the noise.
▪ Control of data acquisition from the PC.
▪ Setup management of the sound level meter.
▪ Firmware upgrade of the sound level meter.
Issuing the documentation for sound level meters is easy thanks to a convenient feature that allows other applications to copy graphs or tables displayed, and the ability to create PDF files.

NS1 - "**Workers Protection** " module: Noise analysis in the work environment in accordance with ISO 9612.
The data for sound level measurements made in the work environment are organized in a project where they can be handled according to regulatory requirements. In addition to calculating the noise exposure of workers, the program allows to assess the effectiveness of protective equipment by the methods SNR and OBM.

NS2A - "**Noise Pollution** " module: analysis of the noise climate and evaluation of road, rail and airport noise.
The application module analyzes sound level profiles detected in internal and external environment for the assessment of climate noise, noise industrial sites, ports, airports and transport infrastructure.
The analysis of the noise climate is done on a daily, weekly and annual basis with a maximum resolution of 1 minute.
The noise profiles detected in the external environment are scanned for sources characterized by a sequence of disturbing events such as railways and airports. The analysis is performed on a daily basis with a resolution equal to 1 / 8 of a second auto-search and analysis of sound events.

NS3 - "Sound Insulation" module: evaluation of passive acoustic requirements of buildings in accordance with ISO requirements. **It requires option HD2110.O4 "Reverberation Time".**
The measures necessary to make the acoustic classification of a building are grouped in a project to simplify their storage and research. You can add measures to a technical report, comments, graphics, photos, etc. that may be useful to document the work.
An updatable database, divided into walls and ceilings, contains the soundinsulating characteristics of the main structures. The data contained in the database can be compared graphically with the measurements.
The program can calculate:
• Average reverberation time (ISO 3382)
• Area of absorption and equivalent sound absorption coefficient (ISO 354)
• Insulation by air: indexes R, R' and D_{nT} (ISO 140/3, 4 and 14 and ISO 717-1)
• Insulation of facades and façade elements: indexes $D_{2m,nT}$ and $R\theta$ (ISO 140/5 and ISO 717-1)
• Insulation of Impact noise: indexes L_n, DL, L'_n and L'_{nT} (ISO 140/6, 7, 8 and 14 and ISO 717-2)

NS4 - "**Monitor**" module: real time acquisition on a PC; synchronized audio recording; remote monitoring and acquisition programming.
The software module allows you to control the sound level meter with PC in remote location. Main functions are:
• Real time display of acquired data in graphical and tabular form.
• Possibility to connect via modem with the sound level meter.
• Acquisition of the sound level meter data directly into the mass memory of the PC (monitor function).
• Calibration and diagnostic functions management.
• Acquisition programming and automatic monitoring.
• Possibility to record audio in sync with the phonometric measures, by using the versatile trigger function.

NS5 - "**Environmental Noise**" module: analysis of noise and environmental noise sources resulting as disturbance to human activities.
The noise profiles detected in indoor or outdoor environments are analyzed with an automated search for tonal or impulsive components.

Options

Option HD2110.O1 "Third Octave": spectral analysis for third octave bands. Spectral analysis for third octave bands in class 1 according to IEC 61260 from 16Hz to 20kHz. Alternative filter bank with octave band centre frequencies shifted by half from 14Hz to 18kHz for the identification of tonal components at the intersection of standard bands.
Audibility of spectral components is evaluated in real time by comparing the spectrum with the noise contours calculated using ISO 226:2003.

Option HD2110.O4 "**Reverberation Time**": measurement of reverberation time is interrupted by the sound source with a pulsed source method according to ISO 3382.
Measurement of reverberation time for octave bands from 125 Hz to 8 kHz and, in combination to HD2110.O1 option for third octave band from 100 Hz to 10 kHz with a sampling interval of 1/32 s.
Automatic calculation of reverberation times EDT, T10, T20 and T30 for all bands and analysis of the decay profile with the ability to calculate the reverberationtime in an interval of your choice.

Option HD2110.O6 "**FFT**": narrow band spectral analysis (FFT).
This option adds:
• Leq Profile at intervals of 1/32 s.
• Narrow band spectral analysis (FFT) from 7 Hz to 22 kHz with variable resolutionsdepending on the frequency from 1.5Hz up to 100Hz.

Ordering codes for instruments and accessories
HD2110L.K1: it includes the HD2110L sound level meter, user's manual, briefcase, HD2110P preamplifier, microphone MC21 for outdoor use, 5m extension cable CPA/5, HD SAV windproof shield, Noise Studio software and RS232 (HD2110/RS) or USB (HD2110/USB) serial cable for connection to a PC. **ACCREDIA Calibration Certificate is supplied**.
HD2110 L.K1/E: version for measuring outdoors. It includes: HD2110L sound level meter, user's manual, briefcase, HDWME protection microphone for outdoor use equipped with protection against birds, windproof and rain-resistant shield, heated preamplifier HD2110PW with 5m connection cable (other lengths on request) and microphone MC21 for outdoor use. This kit also includes the Noise Studio software and the RS232 (HD2110/RS) or USB (HD2110/USB) serial cable for connection to a PC. **ACCREDIA Calibration Certificate is supplied.**
HD2110 L.K1/IE: version for measuring both outdoors and indoors. It includes: HD2110L sound level meter, user's manual, briefcase, HDWME protection

microphone for outdoor use equipped with protection against birds, windproof and rain-resistant shield, heated preamplifier HD2110PW with 5m connection cable (other lengths on request), HD2110P preamplifier, CPA/5 5m extention cable, HD SAV windproof and microphone MC23 for outdooruse and protective membrane. This kit also includes the Noise Studiosoftware and the RS232 (HD2110/RS) or USB (HD2110/USB) serial cablefor connection to a PC. **ACCREDIA Calibration Certificate is supplied.**
HD2110.O1: option "Third Octave" - spectral analysis for third octave bands with double filter bench from 16Hz to 20kHz and from 14Hz to 18 kHz. Calibration Certificate included.
HD2110.O4: option "Reverberation Time" – the measurement of reverberation time is interrupted by the sound source with a pulsed source method according to ISO 3382.
HD2110.O6: option "FFT" - narrow band spectral analysis (FFT) from 7 Hz to 22 kHz with resolution from 1.5Hz to 100Hz.
HD2020: sound level calibrator from 1000Hz 94dB/114dB class 1 according to IEC60942:2003. ACCREDIA Calibration Certificate is supplied.
HD2010MC: SD memory card interface. This device includes a 1GB SD card. It allows SD memory cards to interface to the sound level meter. It can be connected to the sound level meter through the serial interface which also provides the necessary power. In addition to the large storage capacity,the fast interface allows the download of data stored in the internal memory of the sound level meter. It is possible to connect a maximum capacity of 2GB.
HD2110P: microphone preamplifier with standard connection for ½" microphones. It is equipped with the CTC device for the electrical calibration and with a driver for extension cable up to 100m.
HD2110PW: heated microphone preamplifier for the outdoor HD WME device with standard connection for ½" microphones. It is equipped with the CTC device for the electrical calibration and with a driver for extension cable up to 100m. It ends with a connection cable 5 m (other lengths on request).
MC21: Class 1 microphone for free field type WS2F according to IEC 61094-4:1995.
MC22: Class 1 microphone for diffuse field type WS2D according to IEC 61094-4:1995.
MC23: Class 1 microphone for free field type WS2F according to IEC 61094-4:1995. Protected membrane for outdoor use.
HD WME/PMK: microphone unit for outdoor use equipped with protection against birds, windproof and rain resistant shield, heated preamplifier HD2110PW 5m connection cable (other lengths on request) and MC23 microphone.
HD WME/P: microphone unit for outdoor use equipped with protection against birds, windproof and rain resistant shield, heated preamplifier HD2110PW 5m connection cable (other lengths on request).
HD WME: microphone unit for outdoor use equipped with protection against birds, windproof and rain resistant shield.
HD SAV: windproof shield for 1/2" microphone.
HD SAV3: windproof shield for the microphone protection HD WME for outdoor use.
HD WME1: protection against birds for the microphone unit HD WME for outdoor use.
HD WME2: rain resistant protection for the microphone unit HD WME for outdoor use.
HD WME3: stainless steel support for the preamplifier of the microphone unit HD WME for outdoor use.
CPA/5: 5m extension cable for the HD2110P preamplifier.
CPA/10: 10m extension cable for the HD2110P preamplifier.
CPA/20: 20m extension cable for the HD2110P preamplifier.
CPA/50: 50m extension cable for the HD2110P preamplifier.
HD2110/RS: serial RS232 cable for the connection to a PC or to the portable printer HD40.1.
HD2110/USB: serial USB cable for the connection to a PC.
SWD10: stabilized power supply voltage Vin=100...230Vac / Vout=12Vdc/1000mA.
VTRAP: tripod max. height 1550mm.
HD2110/SA: Support to fix the tripod to the preamplifier.
HD40.1: Portable serial thermal printer equipped with power supply SWD10.

Features

Acquisition
• Possibility to acquire the timing profile of 6 simultaneous measurement parameters by freely choosing the time or frequency weightings.
• Possibility to store multiple parameters of the sound level with a capacity of more than 46 hours. Recordings can be searched in the memory and displayed on a graph with the function "Replay" which reproduces the time course of the sound track.
• In addition to sound level profiles, it is possible to capture sequences of relations at programmable intervals from 1 second to 1 hour, with dedicated parameters, average spectra and full statistical analysis. A versatile trigger function is able to identify sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

Dynamic
• The measurements are made with a dynamic that exceeds 110dB and is bounded below only by the intrinsic noise of the instrument. For example, by setting the upper limit of the measures to 140dB, it is possible to perform measurements at noise levels typical of a quiet office with the capacity of measuring accurately peak levels up to 143dB, without indication of overloading.
• With high dynamic range it is possible to make long integrations without worrying about events that may lead to overload or subfield information.

Spectral Analysis
• Simultaneously to the acquisition of six profiles, spectral analysis is performed in real time, both for octave and third octave bands (option HD2110.O1).
• The spectrum of the sound signal is calculated 2 times per second and integrated in a linear up to 99 hours.
• It is possible to do multi-spectral analysis, including maximum or minimum, which is linearly exponentially weighted.
• For a proper evaluation of audibility, the spectral analysis can be weighted A or C or unweighted (Z).
• The spectra are displayed along with a A, C or Z-weigtedwideband level. The spectral analysis for third octave bands (HD2110.O1 option) can be performed, in addition to standard bands from 16 Hz to 20 kHz, with bands shifted down by one-sixth octave, 14 Hz to 18 kHz, for finding them tonal components hidden among standard adjacent bands.
• While displaying the spectrum for third octave bands (HD2110.O1 option), it is possible to activate in real time the calculation function of noise contours for a rapid and accurate analysis of audibility of the different components of the spectrum.
Statistical
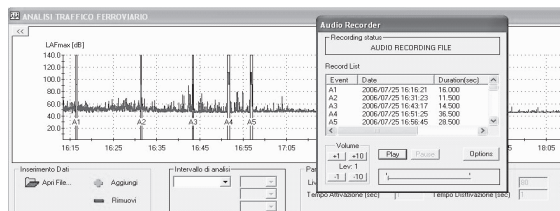
NS4 "Monitor": PC logging with synchronized audio recording.

Statistical Analysis
• As a statistical analyzer, the HD2110L samples the sound level 8 times per second and analyzes it in 0.5dB classes.
• It is possible to choose whether sampling LFp, Leq or Lpk with A, C or Z weightings (only C and Z per Lpk).
• Calculation and graphical display of the probability distribution and the percentile levels L_1 ad L_{99}.

Analogical Input/Output
• For further analysis, the unweighted LINE output allows to record the samples on a tape or directly on a PC with a capture card.
• It is also possible to analyze the audio track recorded with other instruments, by using the LINE input.
• Output DC LAFp 1/8s.

Calibration
• The calibration can be performed with an acoustic calibrator (class 1 according to IEC 60942) or with the built-in reference generator.
• The electrical calibration uses a special preamplifier which tests the sensitivity of the measuring channel, including the microphone.
• The factory calibration, kept in a protected storage area, is used as a reference for the calibration by the user, so to allow the control of drifting and prevent any "out of calibration".

Diagnostic
• The verification of the full functionality of the sound level meter can be made directly by the customer on the field.
• Thanks to a diagnostic program, most of the damages to the instrument, as well as to the microphone, can be easily detected. The diagnostic analysis includes the measurement of the frequency response of the entire measuring chain consisting of a microphone, preamp and sound level meter.
• The periodic execution of diagnostics programs allows performing the sound level measurements with confidence and avoiding any risk of malfunction, discovered late.
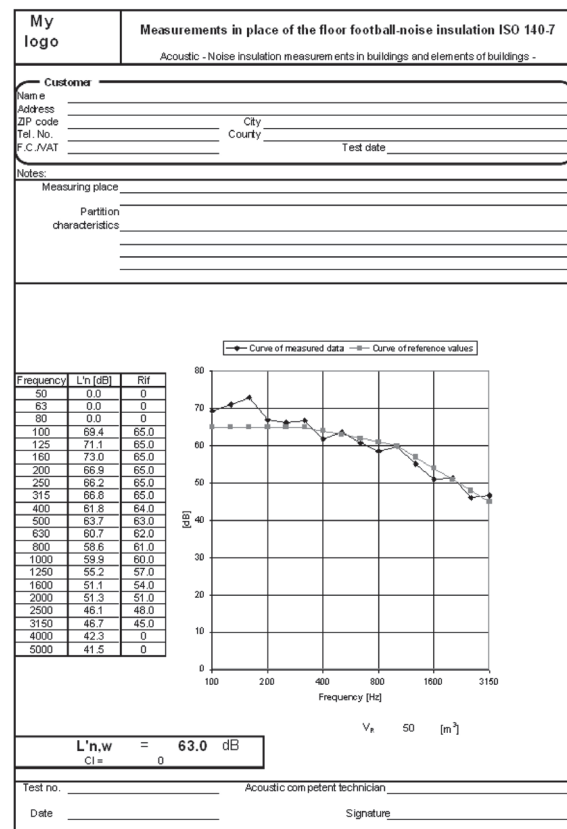

NS3 "Acoustic Insulation": ISO report writing.

SWD10

Connection to a PC

- USB and RS232 interfaces allow quick data transfers from the sound level meter to the mass storage of a PC. In the case of extended recordings where the memory is not sufficient, it is also possible to activate the "Monitor" function which transmits through the serial interface (streaming) the data displayed, by recording them directly on to a PC memory.
- The HD2110L can be completely controlled by a PC via the multi-standard serial interface by using the dedicated communication protocol.
- Via the RS232 interface it is possible to connect the sound level meter to a modem.
- Electrical calibrations and diagnostic tests can be carried out remotely, by using the remote control.
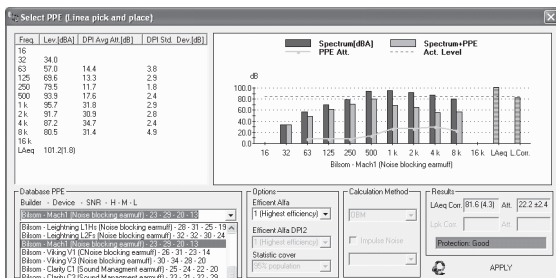
NS1"Worker protection": analysis of PPE efficacy

Reverberation time

- The sound level meter HD2110L, with the "Reverberation Time" option (**HD2110.O4**), can measure the reverberation time by using the method of the stopped source and the method of the integrated impulse response according to ISO 3382.

NS2A "Acoustic Pollution": 24-hour analysis with automatic search of the transit of trains.

- The powerful DSP calculates the sound level meter 32 spectra per second simultaneously for octave and third octave (**in conjunction HD2110.O1 option**), allowing measurements of the reverberation time from 0.375s in accordance with ISO 3382.

Application

Noise Pollution

- You can monitor the sound level, noise mapping and assessments of the noise climate with capture and analysis of sound events.
- In the assessment of noise near airports, rail or road noise, the sound level meter can be used as a recorder of sound events to more parameters, combining the characteristics of spectrum analyzer and statistical.
- The identification of impulsive events is easy, with the ability to analyze the profile of the layer with constant weighting and FAST, SLOW and IMPULSE. All parameters of measurement can be stored for further analysis.
- The identification of tonal components is easier and free of uncertainties by viewing and recording the spectra of the minimum estimated with any weighted broadband (Z, C or A) and for third octave bands both with centre frequencies from standard 16 Hz to 20 kHz and with centre frequencies that move on the intersection of the first from 14 Hz to 18 kHz **(HD2110.O1 option).**

- The audibility of the tonal component, compared with that of the remaining portions of the spectrum, can be evaluated both on the field, thanks to realtime calculation of noise contours (HD2110.O1 option), and with the Noise Studio PC software supplied with the instrument.

Workers protection

- The sound level meter HD2110L is able to perform all the steps required on the protection of workers from the risk of exposure to noise.
- The selection of personal protective equipment can be made with both the octave band spectral analysis (OBM method) and by comparing the weighted equivalent levels and measurable A and C-measured simultaneously (SNR method).
- In case that an undesired sound event produces an overload, or simply alters the result of integration, the contribution can be excluded using the deletion function of unwanted data.
- The calculation of the equivalent time constant IMPULSE (LAIeq) allows the assessment of impulsivity sources.

Technical features	
Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000; Class 0 according to IEC 61260:1995 Type 1 according to ANSI S1, 4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	✓ MC21 condenser microphone, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 ✓ MC23 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof microphone unit) ✓ MC22 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4
Dynamic Range	23 dBA...143 dB Peak
Linear Field	110 dB
Acoustic Parameters	S_{pl}, L_{eq}, L_{Teq}, SEL, $L_{EP,d}$, L_{max}, L_{min}, L_{pk}, Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time in compliance with IEC61260 class 0 specifications ✓ Octave bands from 16 Hz to 16 kHz ✓ Double bank third octave filters with central frequencies from 16 Hz to 20 kHz and from 14 Hz to 18kHz ("HD2110.O1" option) ✓ FFT from 7 Hz to 22 kHz with variable solutions from 1.5 Hz to 100 Hz (option HD2110.O6) Average spectrum (AVR) mode, multispectral mode (MLT), maximum spectrum mode (MAX) and minimum spectrum mode (MIN).
Audibility	Real time comparison of spectrum for third octave bands with the noise contours according to ISO 266:2003 (option HD2110.O1).
Statistical Analysis	Calculation of the probability distribution and the percentile levels from L_1 to L_{99} ✓ Parameter: L_{Fp}, L_{eq}, L_{pk} A, C or Z -weighted (only C or Z for L_{pk}) ✓ Sampling frequency: 8 samples/second ✓ Classification: Classes from 0.5 dB
Analysis of Events	Calculation of 5 freely-programmable event parameters Average spectrum calculation by octave and third octave bands Calculation of statistical levels from L_1 to L_{99} Event identification trigger with programmable threshold and duration filter External and manual trigger
Reverberation Tim	Reverberation time measurement by using sound source interruption or impulse response integration (option HD2110.O4).
Profile Data Logging	1 profile with programmable sampling from 1/8s to 1 hour and 3 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 0.5s to 1 hour (MLT, MAX or MIN mode)
Display	Graphic display 128x64 pixel ✓ 5 parameters in numeric format ✓ Profile parameter to be chosen with sampling from 1/8 second to 1 hour ✓ Octave band spectrum from 16 Hz to 16 kHz ✓ Third octave band spectrum from 16 Hz to 20 kHz or from 14 Hz to 18 kHz (option HD2110.O1) ✓ Graph of the probability distribution of the sound level classes from 0.5dB, 1dB or 2dB ✓ Graph of percentile levels from L_1 to L_{99} ✓ Narrow band spectral analysis (FFT) from 7 Hz to 22 kHz
Memory	Internal, equal to 8 MB (1 profiles for 72 hours or over 46 days by recoding 5 parameters + spectra per minute) External, via the HD2110MC memory card interface, by using SD cards up to 2 GB
Input/Output	✓ RS232 and USB serial interfaces ✓ AC output (LINE) ✓ External trigger for identification of events ✓ DC output
PC Programs	Noise Studio (supplied with the instrument): PC interface for data download, set up and instrument management. Licensed software modules to be enabled by hardware key. ✓ "Worker protection" module. Analysis of noise in workplaces. ✓ "Acoustic pollution" module. climate analysis acoustic noise caused by traffic and transport infrastructure such as railways and airports. ✓ "Acoustic Insulation" module. Calculations of acoustic and architectural evaluation of passive acoustic requirements of buildings (It requires the option "Reverberation time"). ✓ "Monitor" module to capture real-time mass memory in the PC remotely via a modem connected to the sound level meter. The program allows you to program measures and calibrations with timer and record audio with programmable trigger event ✓ "Environmental Noise": Analysis of noise and environmental noise sources with automatic identification of tonal and impulsive sources.
Operating conditions	Working temperature -10...50°C, 25...90%RH (not condensing), 65...108kPa. Protection degree: IP64
Power supply	✓ 4 alkaline type AA or rechargeable NiMH batteries or external 9...12Vdc 300mA
Dimension and weight	✓ 4 alkaline type A445x100x50 mm equipped with preamplifier, 740 g (with batteries)